THEFT AND RURAL POVERTY: RESULTS OF A NATURAL EXPERIMENT

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This paper investigates the relationship between theft and poverty in rural areas. Following a disputed presidential election, fuel supply to the highlands of Madagascar was severely curtailed in early 2002, resulting in a massive -- if temporary -- increase in poverty. This situation constituted a natural experiment of the effect of poverty on theft. Using original survey data collected in June 2002 at the height of the crisis, we find that crop theft increases with poverty and that an increase in law enforcement personnel reduces cattle theft, a form of organized crime. Results suggest that theft is used by some of the rural poor as a risk coping strategy. Increased transport costs led to a rise in cattle and crop theft, suggesting that isolation raises crime.

Keywords: rural poverty, theft, crime, Madagascar, risk coping

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Introduction

There has long been a suspicion that poverty favors criminal activity, but hard evidence of this relationship is difficult to come by. There are several reasons for this state of affairs, all having to do with the joint causality between poverty and crime. First, the prevalence of crime in an area discourages business, hence contributing to poverty. Secondly, high crime areas may also attract criminals because they find it easier to elude detection or because these areas constitute focal points for customers -- think of prostitution or of the drug trade, for instance. Finally, individuals with a high predisposition for crime are likely to have unobservable traits (e.g., lack of discipline) that make them less employable and thus would make them poorer even if they did not resort to crime. For all these reasons, analyses of the relationship between crime and poverty are often regarded with skepticism (Bourguignon 2000, Fajnzylber, Lederman & Loayza, 2001).

Efforts to bypass these problems have focused on natural experiments such as income transfers (Imrohoroglu, Merlo & Rupert 2000, Rephann 1999). At this juncture, the conclusion from the empirical literature is that poverty has little effect on crime (Dreze & Reetika 2000, Krueger & Pischke 1997, Doyle, Ahmed & Horn 1999, Morgan 2000, Blau & Blau 1999, Jarrell & Howsen 1990, Freeman 1996). The available evidence, however, is largely if not exclusively based on data from rich countries -- predominantly the U.S. -- where most crime is related to the drug trade. We know very little about how poverty affects crime in poorer countries, in spite of the fact that crime represents a major welfare issue. In a rare intercountry comparison, Fajnzylber, Lederman and

Loayza (1998) show that many developing countries have crime rates equal to or higher than that of developed countries.

This paper revisits this issue by taking advantage of a natural experiment in Madagascar. Following a disputed presidential election, fuel supply to the central highlands of the country was severely curtailed in early 2002, resulting in a massive -- if temporary -- increase in poverty. This situation, however dramatic it was for the population, enables us to ascertain the immediate effect of poverty on crime. Using data on crime and poverty before and during the crisis in a number of locations or "communes", we examine whether locations where poverty increased more also experienced a higher increase in crime. The originality of this approach is that it controls for many of the factors that plague cross-section or panel analysis, since the shock was too swift to enable reverse causation to manifest itself. Moreover, because fuel prices skyrocketed, there was no massive relocation of population over the time period considered. The large magnitude and unpredictable nature of the shock also are advantages relative to studies that focus on increments in transfers.

This work fits within a growing economic literature on crime and conflicts. While economic analysis of criminal activity in developed countries is well developed (Becker 1968, Morgan 2000, Krueger & Pischke 2000, Imrohoroglu, Merlo & Rupert 2000, Doyle, Ahmed & Horn 1999), research elsewhere in the world is still in its infancy. There is a growing recognition among development economists that crime and conflicts take a heavy toll on the welfare of the poor (Bourguignon 2000, Stewart et al. 1997).

In Madagascar, Fafchamps and Moser (2002) find that crime is higher in isolated, less populated areas, not in urban areas as is common in rich countries. This suggests that the geographical pattern of crime in poor countries might be quite different from that in rich countries. Programme Ilo provides evidence that security is one of the major concerns among the Malagasy people. In 2001,

security conditions in the country were perceived to be bad or very bad by two thirds of rural households. When asked whether security is important to improve living conditions, 83% of the country's rural households stated that security was important or very important. Security in general and crime in particular thus were at the top of citizens' concerns, even before the political crisis that would unfold in the first half of 2002.

The paper is organized as follows. The conceptual framework is introduced briefly in Section 2. The data is presented in Section 3. Empirical analysis appears in Section 4.

Conceptual framework

As starting point for our investigation, we begin by positing a relationship between crime, population, and law enforcement. Let C_{it} denote crime in location i at time t and let P_{it} be total population. Similarly, let D_{it}, R_{it}, and L_{it} denote the number of poor, non-poor, and law enforcement personnel in location i at time t. By construction, $P_{it}=D_{it}+R_{it}$. We posit the relationship:

(1) $$E[C_{it}]=(R_{it}+\gamma D_{it})^{\alpha} L_{it}^{\tau} e^{\lambda(i)+\sigma(t)}$$

where $\lambda(i)$ is a location-specific effect capturing all time-invariant determinants of crime and $\sigma(t)$ is a common time effect. The parameters we are interested in are α, σ, and γ.

Equation (1) essentially says that expected crime is an increasing function of population and a decreasing function of law enforcement. We expect α to be positive and close to 1, i.e., we expect crime to be roughly proportional to population. If law enforcement is effective at deterring crime, σ should be significantly positive. Parameter γ captures the effect of poverty on crime: if the poor and non-poor have the same crime rate, then γ should be unity. In contrast, if crime is more prevalent among the poor, we expect γ to be larger than one.

To facilitate estimation, equation (1) can be transformed into:

(2) $E[C_{it}]=(P_{it}(1+(\gamma-1)D_{it}/P_{it})^{\alpha}L_{it}^{-\tau}\, e^{\lambda}(i)+((t)$

which, after taking logs, is approximately equal to:

(3) log E[Cit] ((log Pit + (((-1)Dit/Pit - (logLit + ((i) + ((t)

Testing whether poverty affects crime boils down to testing whether $\gamma \neq 1$ and thus whether the coefficient of $D_{it}/P_{it}\neq 0$.

Equation (3) is estimated in Section 4. Two estimation methods are used. The first adds zero-mean errors to equation (3) and estimates it using standard fixed and random effect estimators to eliminate $\lambda(i)$. The second regards the number of crime incidents C_{it} as following a Poisson process with mean given by:

(4) $E[C_{it}]= e\,(\alpha \log P_{it} + \alpha(\gamma-1)D_{it}/P_{it} - \tau \log L_{it} + \lambda(i) + \sigma(t))$

Equation (4) is estimated using a conditional fixed and random effect Poisson regressions to eliminate $\lambda(i)$. We expect different types of criminal activity to respond differently to changes in poverty. Certain categories of crime can be seen as a desperate response to poverty, as when someone steals food to feed himself and his family. We expect these types of crime to rise when poverty increases. Other criminal activities may take place within well organized networks and other mafias that restrict entry in crime. Because the poor cannot enter these activities easily, they are largely insulated from poverty shocks.

In Madagascar, cattle theft is a serious endemic problem that plagues specific parts of the country and is facilitated by geographical isolation (Fafchamps and Moser, 2002). According to Rasamoelina (2000) and Razafitsiamidy (1997, cattle thieves are well organized groups that often operate with the complicity of local authorities. Because this form of organization is likely to restrict entry, we expect cattle theft to be relatively insulated from poverty shocks. However, as

commune residents are hit by a major shock, they may sell (part of) their livestock to smooth consumption (Fafchamps, Udry and Czukas 1998). So doing, they also reduce their exposure to cattle raiders. If cattle sales are sufficiently large, this may reduce cattle theft as there is less livestock to steal.

In contrast, crop theft is expected to increase with poverty as people turn to crime to mitigate the effect of the shock on their lives. What remains unclear is whether these forms of crime respond more to an increase in deep poverty -- e.g., chronic lack of food -- or whether it is the moderately poor who temporarily turn to crime as a consumption smoothing strategy. Some empirical evidence to this effect is provided in Section 4.

The data

We estimate the model using data collected in rural Madagascar. What makes these data unique is the very unusual set of circumstances under which they were gathered. In December 2001, the first round of a presidential election witnessed the success of the former mayor of the capital city over the incumbent and long-time president of the country. Two independent vote counts gave the challenger an absolute majority and declared him the winner. But the official ballot count gave the challenger less than 50% of the votes and called for a second round. Suspecting that official results had been rigged, the challenger disputed the official ballot count.

What followed were six months of rampant conflict between the two candidates. The challenger reinforced his control over the capital while the incumbent retreated to Toamasina, the major port city. Rallying under his banner the governors of most provinces except the central highlands, the incumbent then proceeded to blast key road bridges and to blockade the capital city and its

hinterland. The immediate consequence was a sixfold increase of gasoline prices in the highlands and a doubling of transport costs. The ensuing disruption of the economy raised havoc among farmers who could no longer sell their surplus to the market, as well as among urban dwellers who faced sharp increases in food prices. As a result, the country experienced a dramatic -- but hopefully temporary -- increase in rural poverty. Fortunately, the political conflict did not degenerate into an all-out civil war. By the Summer most of the army had rallied the challenger's cause and the incumbent president fled the country in late June. On June 26, the US government recognized the new government. Three days later, France followed suit. The crisis was over.

The data used here were collected during the month of June 2002, just before roadblocks were lifted between the major port city of Toamasina and the rest of the country. The survey focuses on three of the worst affected regions of the country -- the two provinces of Antananarivo and Fianarantsoa located in the central highlands where the majority of the population lives, and the coastal province of Mahajanga which depends on the highlands for supply of consumer goods and outlet for its agricultural surplus. A stratified sampling frame was set up in such a way to be as representative as possible of the situation in these three provinces. Districts (fivondronanas) were divided into six strata depending on the distance to the provincial capital and on the availability of a tarred road. In each strata, one district or fivondronana was selected for every province. In each district, four communes were then selected at random, resulting in a total sample of 72 communes. The small size of the sample is primarily driven by the heroic conditions under which the survey was undertaken, i.e., in the midst of a serious and volatile political crisis that made vehicle transport difficult and movements of enumerators costly and dangerous.[1]

[1] Data collection was undertaken by the USAID-funded Ilo project in collaboration with INSTAT and FOFIFA. INSTAT is the statistical institute of the Ministry of Economy and Planning. FOFIFA is a the agricultural research institute within the Ministry of Scientific Research. This project has a

Via interviews with key informants and focus groups -- typically local administrators, public servants, traders, and farmers -- the survey collected detailed information on crime incidence in the April-May 2002 period immediately preceding the survey, as well as on the April-May 2001. Given the high seasonality in incidences in crime (Razafitsiamidy 1997) and in poverty (Minten and Zeller 2000), data were gathered for comparable periods during the year. Respondents were also asked to evaluate the proportion of the population experiencing difficulties feeding themselves during the same period, as well as the number of law enforcement personnel operating in the commune.

Answers are summarized in Table 1, together with t-tests for the difference between 2001 and the corresponding period in 2002. We see that cattle theft remained constant over time while crop theft went up -- but the t-statistic is not significant. We report two distinct poverty lines: the percentage of commune residents who face difficulties feeding themselves throughout the year, and the percentage of those who face occasional difficulties feeding themselves. We call the first the chronically food insecure and the second the temporarily food insecure. By construction, the second category includes the first. Table 1 shows that both measures of poverty went up significantly with the crisis. The magnitude of the effect is quite large, especially on temporary poverty. The bottom of Table 1 also reports changes in law enforcement personnel between 2001 and 2002. The figures show no change over time, albeit there are changes within communes between the two years. Table 1 further shows that transport costs doubled between 2001 and 2002.

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long experience collecting data in Madagascar and had just completed a census of all communes in the country before the December elections. The census could thus be used as sampling frame for the survey discussed here.

Empirical results

We are now ready to turn to our estimates of equation (3). To avoid losing zero observations, we add one to the dependent variable and to the number of law enforcement personnel before taking logs. Regressions include the two measures of poverty reported in Table 1. Since, by construction, the chronically insecure are included in the temporary insecure, the coefficient on the temporarily food insecure should be interpreted as the effect of poverty in general, while the coefficient of the chronically food insecure measures the additional effect of severe poverty. A 2002 year dummy is included to control for the possible presence of a common shock, e.g., lawlessness induced by the deleterious political climate.

Table 2 reports first OLS regression estimates using commune fixed-effect and random effect estimators. A Hausman test is also provided to compare the fixed and random effect results. Except in the case of cattle rustling, we fail to reject the random effect model. Results show that an increase in poverty is associated with a rise in crop theft but has no significant effect on cattle theft. These results are in agreement with expectations: theft increases with poverty while organized crime (cattle theft) are insensitive to changes in poverty. Results indicate that it is our broad definition of poverty that is associated with crop theft, not the number of chronically poor. Crime therefore appears as a consumption smoothing strategy by the not-so-poor as they seek to protect their standards of living. The 2002 dummy is not significant in any of the regressions, indicating that lawlessness did not systematically increase over and above the effect of poverty and law enforcement.

In contrast, changes in law enforcement personnel are associated with a drop in cases of cattle theft. The effect is only significant in the fixed-effect regression, but this is our preferred regression since

the Hausman test rejects the random effect model. This result suggests that prevention and deterrence is highest for organized crime. It is also conceivable that cattle thieves, who operate over a large territory, simply shift their operations to other communes in response to movements in law enforcement personnel. This issue deserves more investigation.

Because crime remains a rare event, ordinary least squares is not the most efficient estimator. Assuming that crime follows a Poisson distribution with incidence rate given by equation (4), this specification probably provides a more accurate representation of the data generation process and is thus likely to be more efficient. This is true for the Poisson random effect model. Once we control for commune fixed effects, however, this need no longer be the case. The reason is that, like the fixed-effect logit estimator, the fixed-effect Poisson estimator is a conditional estimator, meaning that all observations in which the dependent variable is unchanged are not used for estimation purposes. Throwing away observations reduces efficiency.

Table 2 further reports estimates of the model using a fixed-effect (conditional) Poisson estimator as well as a random effect Poisson estimator. Unlike in the case of standard fixed and random effect models, we cannot use a Hausman test to compare the two Poisson models. This is because the fixed effect Poisson estimator is conditional, that is, uses only observations for which the dependent variable changes over time. As for OLS, we find that temporary poverty has a significant positive effect on crop theft and that law enforcement has a significant negative effect on cattle theft. Chronic poverty has a positive effect on cattle theft. One possible explanation is that commune residents sold livestock to deal with a temporary shock, hence reducing the number of animals that could be stolen. At the same time, chronically poor households may have turned to cattle theft out of desperation.

Unlike in the OLS fixed and random regressions, Poisson regressions suggest that isolation – measured by transport costs to the nearest major town – has a positive effect on rural theft. This is particularly strong in the fixed-effect regression. This is consistent with the results reported by Fafchamps and Moser (2002) who show that crime in rural Madagascar increases when roads are washed out by hurricanes.

Conclusion

In this paper we use data from a natural experiment to investigate the relationship between theft and poverty in rural Madagascar. This paper is one of very few efforts to understand criminal activity in poor countries. What makes the investigation unique is the timing of data collection: right in the middle of a serious and volatile political crisis that led to a blockade of the heartland of the country. Disruption to road transport and agricultural production was massive and it resulted in a dramatic -- if only temporary -- increase in poverty. Because the political crisis was resolved with little bloodshed, there was no refugee crisis and the damage is nearly exclusively economical. This unusual sequence of events thus provides us with a unique way of assessing the effect of poverty on theft while keeping other theft determinants unchanged. The large magnitude of the shock compensates for the small size of the sample.

Fixed-effect regressions are estimated for a least squares and a Poisson model. Two alternative sets of poverty measures are used. Results suggest that crime increases with poverty. Our most conclusive results are for crop theft where poverty is shown to have a significant effect with both poverty measures in Poisson regressions and in the standard fixed and random effect models with food insecurity as measure of poverty. Contrary to expectations, it is not chronic poverty that has

the strongest effect on crime, but temporary poverty. This suggests that some households use crop theft as a consumption smoothing device. We also find that an increase in law enforcement personnel reduces cattle theft, possibly because thieves move their activities elsewhere. Finally, the Poisson regression results suggest that poverty may reduce cattle theft as households liquidate livestock to generate much needed funds.

Results presented here provide evidence that crop theft is used by some of the rural poor as a risk coping strategy. Because criminal activity is often local in nature, other people affected by similar shocks bear the brunt of crime. For this reason, we expect the poor to bear much of the welfare cost of crime and of the associated distortions and waste of resources in crime avoidance. The relationship between poverty and crime is thus likely to be important, especially in more isolated rural areas (Fafchamps and Moser, 2002). This issue deserves more research.

Bibliography

Becker, Gary S. 1968. "Crime and Punishment: An Economic Approach." Journal of Political Economy 76:169-217

Blau, Judith R. & Peter M. Blau. 1982. "The Cost of Inequality: Metropolitan Structure and Violent Crime." American Sociological Review 47(1): 114-129

Bourguignon, Francois. 2000. "Crime, Violence, and Inequitable Development." Annual World Bank Conference on Development Economics 1999: 199-220

Doyle, J.M., Ahmed, E. & R. Horn. 1999. "The Effect of Labor Markets and Income Inequality on Crime: Evidence from Panel Data." Southern Economic Journal 65(4): pp. 717-738

Ehrlich, I. 1973. "Participation in Illegitimate Activities: A Theoretical and Empirical Investigation." Journal of Political Economy, 81(3): 521-65

Fafchamps, Marcel & Chris Moser. 2002. Crime, Isolation and the Rule of Law. Mimeo

Fafchamps, M., Udry, C. and K. Csukas. 1998. "Drought and Saving in West-Africa: Are Livestock a Buffer Stock?" Journal of Development Economics, 55(2): 273-305

Fajnzylber, Pablo, Lederman, Daniel & Norman Loayza. 1998. Determinants of Crime Rates in Latin America and the World. The World Bank. Washington DC.

Fajnzylber, Pablo, Lederman, Daniel & Norman Loayza. 2001. Inequality and Violent Crime. World Bank. mimeo

Freeman, Richard B. 1996. "Why Do So Many Young American Men Commit Crimes and What Might We Do About It?" Journal of Economic Perspectives 10(1):25-42

Imrohoroglu, A., Merlo, A. & P. Rupert. 2000. “On the Political Economy of Income Distribution and Crime.” International Economic Review 41(1): 1-25
Jarell, S. & R Howsen. 1990. “Transient Crowding and Crime.” American Journal of Economics and Sociology 49:483-493
Krueger, A.B. & J.S. Pischke. 1997. “A Statistical Analysis of Crime against Foreigners in Unified Germany.” Journal of Human Resources 32(2): 182-209
Minten, Bart & Manfred Zeller. 2000. Beyond Market Liberalization: Welfare, Income Generation and Environmental Sustainability in Rural Madagascar. Ashgate: Aldershot, UK.
Morgan, Kelly. 2000. “Inequality and Crime.” Review of Economics and Statistics 82(4): 530-539
Pradhan, M. & M. Ravallion. 1999. Demand for Public Safety. Technical Report. The World Bank. Washington DC. Policy Research Working Paper 2043.
Programme Ilo. 2002. Rural Insecurity and the Political Crisis. Crise Politique. Policy Brief. No. 8. Cornell University. Antananarivo, Madagascar.
Rasamoelina, Henri. 2000. Etat, Communautés villageoises et banditisme rural : L’exemple du vol de bœufs dans la Haute-Matsiatra, Madagascar. Ph.D. Thesis. Université de Perpignan et Fianarantsoa
Razafitsiamidy, Atoine. 1997. Le vol de bœufs dans le sud de Madagascar. Ph.D. Thesis. Etudes Africaines, INALCO, Paris
Rephann, Terance J. 1999. “Links between Rural Development and Crime.” Papers in Regional Science 78(4):365-86
Stewart, Francis, Humphreys, F.P. & N., Lea. 1997. “Civil Conflict in Developing Countries over the Last Quarter of a Century: An Empirical Overview of Economic and Social Consequences. Oxford Development Studies 25(1):11-41

Table 1: Descriptive statistics

Item	Unit	April/May 2001		April/May 2002		Paired t test	
		Mean	Median	Mean	Median	t-value	P>t
Incidences of crime							
Zebu theft	Number per month per commune	27.03	1.50	33.90	0.50	-0.458	0.647
Crop theft	Number per month per commune	1.85	0.00	2.65	1.00	-1.146	0.254
Measures of poverty							
Poor	% of population that face temporary problems to find enough to eat	44.12	40.00	58.25	70.00	-2.735	**0.007**
Extreme poor	% of population that face chronic problems to find enough to eat	11.69	5.00	15.90	10.00	-1.603	0.111
Law enforcement personnel							
	Number per commune	54.04	44.00	54.34	43.00	-0.041	0.967
Transport costs							
Transport costs of a person one way to a major city (Fmg)		26687	20000	52979	37500	-3.991	**0.000**
Transport costs of a bag of 50 kg one way to a major city (Fmg)		8973	6750	16778	13750	-4.735	**0.000**

Number of communes in the survey=72

Table 2: Determinants of theft

		Dependent variable (log (Number of incidences per month per commune+1))							
		OLS				Poisson regression			
Determinants	Unit	Zebu theft		Crop theft		Zebu theft		Crop theft	
		Coefficient	t-value	Coefficient	t-value	Coefficient	z-value	Coefficient	z-value
Fixed effect model									
law enforcement personnel	log+1	-3.812	**-2.320**	-1.033	-1.150	-5.440	**-9.260**	-2.055	-1.320
poor (temporary food problems)	% of pop.	-0.001	-0.090	0.013	**3.200**	-0.004	-1.490	0.018	**3.660**
extreme poor (chronic food problems)	% of pop.	0.006	0.360	-0.005	-0.520	0.022	**2.090**	0.012	0.700
transport costs to major city	log(Fmg)	-0.070	-0.180	0.429	2.000	1.080	**6.220**	1.668	**3.500**
time dummy	2002=1	0.173	0.480	-0.305	-1.550	-0.294	**-1.850**	-1.369	**-3.000**
intercept		16.240	**2.230**	-0.147	-0.040				
sigma_u		3.856		1.385					
sigma_e		0.818		0.449					
rho		0.957		0.905					
number of observations		142		142		92		78	
Joint test if 2 poverty categories diff. from 0									
F(2,66)		0.06		5.17		5.71		14.26	
Prob>F		0.94		0.01		0.06		0.00	
Random effect model									
law enforcement personnel	log+1	0.430	1.740	0.091	0.770	-3.340	**-5.470**	0.213	0.710
poor (temporary food problems)	% of pop.	0.003	0.570	0.010	**3.530**	-0.005	**-1.860**	0.010	**2.700**
extreme poor (chronic food problems)	% of pop.	-0.003	-0.270	-0.009	-1.520	0.041	**3.880**	-0.005	-0.400
transport costs to major city	log(Fmg)	0.227	1.450	0.034	0.450	1.141	**7.170**	0.278	1.530
time dummy	2002=1	-0.124	-0.630	0.031	0.310	-0.483	**-3.350**	-0.065	-0.310
intercept		-2.392	-1.250	-0.343	-0.370	7.189	**2.060**	-3.190	-1.380
sigma_u		1.521		0.721					
sigma_e		0.818		0.449					
rho		0.776		0.721					
number of observations		142		142		142		142	
Joint test if 2 poverty categories diff. from 0									
F(2,67)		0.33		12.48		16.27		7.31	
Prob>F		0.85		0.00		0.00		0.03	
Hausman test									
Chi2(5)		13.06		6.65					
Prob>chi2		0.02		0.25					